SHOPERA:
Task 1.1: Environmental Conditions
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Environmental Conditions for Assessment of Sufficient Manoeuvrability

- Sources:
  - Environmental conditions during groundings and collisions: statistics from SOLAS, HARDER, GOALDS
  - Accident investigations
  - Interviews with ship masters
Environmental Conditions:

<table>
<thead>
<tr>
<th>$L_{pp} ,[m]$</th>
<th>$h_s ,[m]$</th>
<th>$T_p ,[s]$</th>
<th>$V_{\text{Wind}} ,[m/s]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;200</td>
<td>4.0</td>
<td>7.0 bis 15.0</td>
<td>15.7</td>
</tr>
<tr>
<td>&gt;250</td>
<td>5.5</td>
<td>7.0 bis 15.0</td>
<td>19.0</td>
</tr>
</tbody>
</table>

- Reduction up to $h_s=4.0 \, m$ follows from the application of advance speed and course-keeping criteria (background of the Minimum Power Guideline) to small tankers and bulk carriers ($\text{DWT} \approx 20000 \, t$)

- under assumption that all „EEDI Database“ ships are sufficiently manœuvrevrable in adverse conditions
Environmental Conditions: Accident Statistics etc.

- Background of SOLAS:
  - HARDER: collisions happen mostly in calm water, and very rara at $h_s > 4.0$ m
  - Groundings were not taken into account – note however that adverse weather conditions are more relevant to groundings that to collisions
  - Therefore, further databases should be evaluated (GOALDS?)
- Accident investigation: grounding in heavy weather of bulk carrier *Pasha Bulker*:
  - Figure: number of ships at anchor vs. $h_s$: 80% of ships at $h_s=4.5$ m and 20% of ships at $h_s=6.0$ m
- Accident investigation reports of MAIB (Marine Accidents Investigation Branch): in work
- Interviews with ship masters (container ships and bulk carriers): in work
- ANEP-79 (2007) Controllability and Safety in a Seaway:
  - Operability for most operations: Bft6, $h_s=4.0$ to 6.0 m
  - Rescue and patrol: no weather limitations
Environmental Conditions: Summary

- MEPC 65/4/3, Annex 1 (2013), *Minimum Power Guideline*: $h_s = 4.0$ to $5.5$ m
- SOLAS (HARDER): $h_s < 4.0$ m
- Grounding of bulk carrier *Pasha Bulker*: $h_s = 6.0$ m
- ANEP-79 (2007) Controllability and Safety in a Seaway: $h_s = 4.0$ to $6.0$ m (operability) up to maximum wave heights (rescue and patrol)
- Ongoing work:
  - Accident investigation reports by MAIB (Marine Accidents Investigation Branch)
  - Interviews with ship masters (container ships and bulk carriers)
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